

Diagnostic tools of heart failure with preserved ejection fraction: Comparison of left atrial strain to the HFA-PEFF score

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Introduction: Heart failure with preserved ejection fraction (HFpEF) is an increasingly common health issue with a significant morbidity and mortality burden. Diagnosis remains challenging despite the great number of tests and parameters proposed. The aim of this study is to assess the performance of left atrial strain (LAS) function in the diagnosis of HFpEF by comparison to the HFA-PEFF score.

Methods: A total of 110 outpatients, symptomatic with exertion dyspnea, were prospectively recruited over the span of 18 months. The HFA-PEFF score was calculated for all patients, who then were sorted in 2 groups : with and without HFpEF. Performance of LAS functions (reservoir, pump, conduit) and the 2016 ASE/EACVI algorithm for the evaluation of Left ventricular filling pressure (LVFP), was assessed for the diagnosis of HFpEF.

Results: Prevalence of HFpEF in our sample was 40%. All LAS functions were significantly correlated to the presence of HFpEF and to the elevation of LVFP at rest and on exertion. Performance of the 2016 algorithm was mediocre in the diagnosis of HFpEF (AUC=0.70, Specificity (Sp) = 71.2%, Sensitivity (Sn) = 72.7%, Accuracy (Acc) = 71.8%), with significant improvement after exclusion of indeterminate LVFP cases (AUC = 0.89, Sp = 94%, Sn = 84.2%, Acc = 89.7%), and only reaching maximal overall performance (AUC = 0.94, Sp = 94%, Sn = 94.7%, Acc = 94.3%) after exercise testing.

Performance of LAS functions yielded acceptable results, with the reservoir function having the most optimal outcomes, compared to booster and conduit functions, with a cutoff value of 24% (AUC = 0.91, Sp = 86%, Sn = 89.5%, Acc = 88.1%).

Considering the low sensitivity of the 2016 algorithm, we integrated the study of LAS reservoir function when LVFP were evaluated to be normal or indeterminate. The proposed new algorithm demonstrated improved performance (Sp = 90.7%, Sn = 90%, Acc = 90.1%) compared to the 2016 algorithm with inclusion of indeterminate LVFP cases.

Conclusion: LAS reservoir function is an efficient, easy to assess parameter that significantly improves the diagnostic yield of HFpEF in common practice, and diminishes the necessity of exercise echocardiography and invasive testing.

Left ventricular echocardiographic abnormalities in hemodialysis patients: Findings of a monocentric survey

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Introduction: Volume overload in hemodialysis patients triggers structural and functional cardiac changes that define uremic cardiomyopathy. Echocardiography provides a means of diagnosing cardiac abnormalities and guiding therapeutic management. Our aim was to study the echocardiographic signs of left ventricle (LV) abnormalities in hemodialysis patients.

Methods: This was a prospective, monocentric study, carried out from August to September of the year 2018, involving vascular hemodialysis patients at the Lac dialysis clinic.

Results: We investigated 40 patients. Sixty-two percent were males, with a sex ratio of 1.6. The median age was 64 years, with values ranging from 35 to 90 years. The most prevalent comorbidities were arterial hypertension (78%), followed by diabetes mellitus (31%), smoking (25%), obesity (23.8%) and dyslipidemia (21.4%). The most frequent aetiology of renal failure was Atherosclerotic vascular nephropathy (45.24%), followed by glomerulonephropathy (35.71%). An LV dilation was observed in 35.7% of the population, with 7% of severe LV dilation cases. LV hypertrophy was noted in 61.9% of the cases, with 30.95% of eccentric LV hypertrophy, and 14% of concentric remodeling. The mean Simpson LV ejection fraction was 60.12 ± 8.47 %. Only six patients (14,3%) had a mildly reduced LV ejection fraction, two of them related to ischemic heart disease. In 61,5% of the patients, Tei index was impaired while 84.6% had a decreased lateral mitral S-wave velocity.

Conclusion: Renal failure remains a challenging condition with considerable cardiac repercussions, and an echocardiographic follow-up is needed to detect early functional and structural damage.

Right ventricle's echocardiographic parameters predictors of poor outcome in chronic heart failure patients

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Introduction: The prognostic significance of the right ventricle has recently been recognized in several conditions. Recent studies suggest the significance of RV function in the outcome of patients with CHF. Data related to RV's echocardiographic parameters predicting hospitalization for HF and death in CHF patients remain scarce.

Methods: This is a prospective, observational, and analytic mono-centric study, conducted from January 2021 to December 2022 in the Internal Security Forces Hospital of Marsa Tunisia with a 1-year follow-up. The endpoint of our study was to evaluate the RV's echocardiographic parameters predictors of poor outcome including acute heart failure hospitalization and death in CHF patients.

Results: We included 93 patients with CHF. The mean age was 62 ± 9 years old. The sex ratio M/W was of 3.65. Obesity was present in 24% of patients, HTN in 51%, diabetes in 62%, dyslipidemia in 50%, smoking in 70%, CKD in 20%, and OSAHS in 76%. Twenty-six percent of patients had HFpEF, 18% had HfmrEF and 56% had HFrEF. Thirty patients were hospitalized for HF or died. After multivariate analysis, the free wall RV strain was found to be a predictive factor of poor outcome (ORa = 1.234; 95% CI 1.063-1.406; $p=0.006$). After the ROC curve analysis, a cut-off >17 was found with a sensibility of 60% and specificity of 80% (OR= 5.2; 95% CI 2-13; $p< 0.001$).

Conclusion: The echocardiographic study of the right ventricle is crucial. The free wall RV strain remains the most incriminated parameter in poor outcome in CHF patients.

Left atrial strain as a predictor of the severity of coronary artery disease in acute coronary syndrome

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Introduction: Left atrial (LA) strain was recently found useful to predict elevated left ventricular (LV) filling pressures non invasively. However, it's value in predicting the severity of coronary artery disease (CAD) has been little studied.

Aim: To study the value of LA strain in predicting the severity of CAD in non ST elevation acute coronary syndrome (NSTEMI) patients.

Study design: We included in the study 92 patients admitted for NSTEMI-ACS at the hospital of interior forces of Marsa and undergoing coronary angiography

during hospitalisation. Measurements of conventional echocardiographic parameters as well as LA strain parameters were obtained. The severity of CAD was assessed using the SYNTAX score I (SSI).

Results: The mean age of our patients was 59 ± 9 years. As for the comorbidities, diabetes and smoking were the most frequent (58% and 57% respectively). Mean left ventricle ejection fraction (LVEF) was $61 \pm 7\%$.

Patients were categorized into 2 groups: A group with low $SSI < 22$ (Group A) and a group with intermediate to high SSI (Group B). Both Peak atrial longitudinal strain (PALS) (Group A: $29 \pm 7\%$, Group B: $21 \pm 4\%$; $p < 0.001$) and Peak atrial contraction strain (PACS) (Group A: $15 \pm 5.8\%$, Group B: $11 \pm 4\%$; $p < 0.001$) were significantly lower in patients with higher SSI. A significant negative correlation was found between PALS and SSI. A $PALS > 25\%$ predicts an intermediate to high SSI (OR= 5,4 ; 95% IC : 1,11-26 ; $p=0,036$).

Conclusion: The analysis of LA strain by 2D doppler echocardiography can predict the severity of coronary stenosis in NSTEMI-ACS patients assessed by SYNTAX score I.

Key words: Left atrial strain, Two-dimensional echocardiography, Non ST elevation acute coronary syndrome, coronary artery disease, SYNTAX score I.

Effect of percutaneous atrial septal defect device closure on right ventricular form and function

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Introduction: Atrial septal defects (ASDs) constitute about 10% of all congenital heart defects, often resulting in complications such as pulmonary hypertension, atrial arrhythmias, and right heart failure. Transcatheter closure has emerged as a viable alternative to surgical intervention for secundum ASDs, with studies showcasing enhanced hemodynamics and functional outcomes in right ventricular (RV) function post-intervention.

Aim: This study aimed to scrutinize the impact of transcatheter ASD closure on RV morphology, function, and pulmonary pressure.

Methods: Twelve patients were retrospectively included, each undergoing standard two-dimensional echocardiography and myocardial strain imaging pre- and post-ASD closure. Parameters such as blood flow velocities at the tricuspid valve, RV size, fractional area change, tricuspid annular plane systolic excursion (TAPSE), and 2D global longitudinal strain (GLS) were assessed.

Results: The average age of patients was 24.3 ± 17.5 years. Post-closure, statistically significant improvements were observed in RV volumes, fractional area change, TAPSE (17mm to 23mm, $p= 0.004$), and free wall longitudinal strain (-19.7% to 24.8% , $p = 0.001$). Additionally, a notable reduction in pulmonary artery systolic pressure was noted post-closure.

Conclusions: Transcatheter ASD closure yields favorable outcomes, evidenced by improved RV function and volume. These hemodynamic enhancements shed light

on the symptomatic relief achieved through transcatheter ASD closure, affirming its efficacy as a therapeutic approach.

Heart failure therapeutic units improve left ventricular ejection fraction

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Introduction: It has been observed that patients with heart failure and reduced ejection fraction (HFrEF) can experience improvement in their left ventricular ejection fraction (LVEF) (from $\leq 40\%$ to $>40\%$).

Aim: To investigate whether adherence to heart failure therapeutic units (HFTU) could influence the improvement of LVEF.

Methods: We conducted a prospective, descriptive study in our cardiology department over a period of 12 months. We enrolled 146 patients with chronic HFrEF, divided into two groups, patients receiving care in the HFTU and those receiving standard care. Patients assigned to the HFTU had more frequent follow-up visits, and received prompt initiation of medical therapy. At the end of follow-up, we examined the impact of enrollment in HFTU on the improvement of LVEF.

Results: The average age of our population was 62.73 ± 11.4 years, with a male majority (80.1%). Out of the 146 patients, 95 were assigned to the HFTU, while 51 received standard care. Ischemic heart disease was the predominant underlying condition (57.5% of cases). The mean LVEF at baseline was $30.39 \pm 7.5\%$. On average, 36.3% of patients received optimal medical therapy (OMT), with 51.6% from the HFTU group and 7.8% from the standard care group.

Throughout the follow-up period, the average LVEF was $33.78 \pm 10.6\%$, improvement in LVEF was noted in 36 patients (24,7%). The HFTU group demonstrated a significantly greater improvement in LVEF compared to the standard care group (34,7% vs 5,9%; $p < 0.001$).

Conclusion: Adherence to HFTU contribute to the improvement of LVEF in patients with chronic HFrEF.

Effect of mechanical treatment in severe obstructive sleep apnea syndrome: echographic evaluation of right ventricular function

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Introduction: Obstructive sleep apnea syndrome (OSAS) is a common pathology. The standard treatment for severe OSAS is continuous positive airway pressure ventilation (CPAP).

Our study aimed to investigate the effects of CPAP on echocardiographic parameters, particularly its impact on right ventricular function in severe OSAS.

Methods: It was a cross-sectional analytical comparative study conducted at the cardiology department of Menzel Bourguiba Hospital comparing 100 patients with severe OSAS : the first group with at least one year of CPAP therapy (n=50) and the second group without CPAP therapy (n=50). We studied the structural and functional analysis of the Right Ventricle (RV) in both groups.

Results: The average follow-up was 68 months. Right ventricular systolic dysfunction was found in 25% of cases, with a significant difference after CPAP therapy ($P=0,001$). The mean S' wave velocity was significantly higher in CPAP-treated patients ($p=0,028$). The diastolic profile of the right ventricle revealed a higher E/E' ratio at the tricuspid annulus for the non-CPAP group ($p=0,007$). Diastolic dysfunction of the right ventricle was found in 16% of the population (81% in non-CPAP vs 19% in CPAP, $P=0,006$). A significantly higher tissue Tei index was found in non-CPAP patients ($P < 0,001$). Diastolic and systolic right ventricular dysfunction was noted in 49 patients (75% in non-CPAP vs 24% in CPAP, $P=0,000$).

In univariate and multivariate analysis, a correlation between right ventricular dysfunction and CPAP therapy was confirmed ($P < 0,001$).

Conclusion: In severe OSAS, CPAP therapy improved quality of life and delayed the onset of right ventricular diastolic and systolic dysfunction.

Incidence of cardiotoxicity in a cardio-oncology unit

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Introduction: The increasing incidence of cancer is accompanied by improved survival, but also by risks of cardiovascular complications. Managing cardiovascular comorbidities is essential to improve the overall prognosis of cancer and cardiovascular health.

Objective: To study the value of cardio-oncology units in the diagnosis and monitoring of Chemotherapy-related cardiac dysfunction.

Methods: We conducted a prospective, single-center study including 221 patients followed at our cardio-oncology unit from 2023 to 2024. Regarding cardiotoxicity, we identified patients classified as high or very high risk and those who experienced cardiotoxicity.

Results: The mean age was 62 ± 13 year. The most common cancer type was breast cancer 38.9%. 12.2% of patients experienced chemotherapy-induced cardiotoxicity. 96.3% were female with a mean age of 55.5 ± 13 years. 68% were receiving Anthracycline, 72% Anti-HER2 therapy, 24% Taxol, and 3.7% Cisplatin. The initial HFA ICOS score was as follows: Low 37%, Moderate 51.9%, High 3.7%, Very High 7.4%. The distribution of cardiotoxicity stages was: asymptomatic mild 46.2%, asymptomatic moderate 11.5%, symptomatic mild 3.8%,

symptomatic moderate 34.6%, symptomatic severe 3.8%. 22.2% had left ventricular dysfunction, with a mean initial LVEF of $62.15 \pm 5.8\%$ and post-cardiotoxicity LVEF of $52 \pm 8\%$. 37% had isolated decrease in GLS, which was initially $-18 \pm 2.7\%$ and post-cardiotoxicity at $-15.2 \pm 2.3\%$. They were all treated with cardioprotective therapy with 52.4% showing recovery and continued their cancer treatment.

Conclusion: By integrating cardio-oncology consultation into standard treatment protocols, we can optimize the effectiveness of anticancer therapies while reducing negative impacts on the cardiovascular system.

Assessing left ventricular function in severe sepsis: the role of speckle tracking imaging

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Introduction: Septic shock presents a challenge in critical care, often accompanied by cardiovascular complications including left ventricular dysfunction. Conventional methods may inadequately capture myocardial changes. Speckle tracking imaging offers promise in assessing LV function by providing insights beyond traditional measures.

Methods: This is a single-center prospective study including 30 patients admitted to the ICU of the military hospital of Tunis within 48 hours of diagnosis of severe sepsis or septic shock. 2D echocardiography and a parallel assessment of left ventricular function by speckle tracking was performed within 48 hours of the onset of the septic episode. They were reassessed after 3 and 7 days

Results: There were no significant differences between the two groups in terms of age (Mean age 56 y.o), sex (sex-ratio : 1.14), systolic and diastolic blood pressure, heart rate and use of vasoactive drugs. 60 % of patients died.

In the non survivors' group, LVEDD, LVESD and LVEF were conserved. We concluded that the survivors dilated their LV in the early phase of sepsis.

The peak systolic strain in day 3 in the survivors group was $-18.44\% \pm 3.37$ vs $-14.68\% \pm 4.03$ in non survivors group ($p=0.013$), and in day 7 it was $-17.74\% \pm 4.53$ vs $-11.75\% \pm 4.34$ ($p=0.005$)

We conclude that GLPS is frequently reduced in non survivors with septic shock within the first 3 days

Conclusion: Strain is an important parameter for evaluating LV function and could detect its dysfunction at early stages

Evaluating right ventricular function via speckle tracking imaging in repaired tetralogy of fallot

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Introduction: Right ventricular (RV) function significantly impacts the long-term prognosis of patients following tetralogy of Fallot (TOF) surgery. However, evaluating it remains challenging. Speckle tracking emerges as a promising tool for assessing post-TOF surgery RV systolic function.

Methods: 2D-Echocardiography was performed in 30 patients (group1). RV fractional area change (FAC), TAPSE (tricuspid annular plane systolic excursion), S-wave velocity with tissue Doppler at the tricuspid annulus and 2D strain (maximal longitudinal systolic strain) were measured in the 4-cavity view. The results were compared with echocardiographic data from a group of 25 controls (group2) and, in a second step, with MRI data on RV function from 14 patients.

Results: Analysis of echographic parameters showed that the RVEDD and RVESD were significantly larger in group 1 than in the control group ($p=0.03$). Analysis of tissue Doppler parameters at the level of the tricuspid annulus showed that peak S wave was significantly reduced after complete TOF correction ($p=0.001$).

The global RV strain ($-15 \pm 6.5\%$) and that of the free wall were significantly more impaired after TOF treatment ($p<0.001$). Conversely, the LVEF was comparable between the 2 groups, and analysis of tissue Doppler at the mitral annulus found no significant difference between the two groups. TAPSE, FAC and S-wave velocity did not correlate with MRI data. Global 2D strain correlated significantly with RVEF on MRI ($p=0.03$).

Conclusion: Post-TOF surgery, significant alterations in RV parameters underscore the importance of monitoring RV function. Integrating speckle tracking into routine assessments could improve management strategies for TOF patients.

Echocardiographic impact of sleep apnea on right ventricular function in heart failure patients.

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Introduction: Sleep apnea syndrome (SAS) is common in patients with heart failure. It represents the most common comorbidity affecting between 50% and 80% of all patients. SAS is divided into obstructive sleep apnea syndrome (OSAS), caused by intermittent upper airway obstruction, and central sleep apnea syndrome (CSAS), defined as a periodic loss of central respiratory control. Several studies have demonstrated subclinical functional impairment of the right ventricle in patients with SAS.

Aim: Echographic impact of sleep apnea syndrome on right ventricular function in heart failure patients.

Methods : Prospective longitudinal monocentric study conducted on 87 patients recruited during hospitalization for acute heart failure in the cardiology department of the Internal Security Forces Hospital from January 2022

to December 2022. These patients underwent ventilatory polygraphy (PV) and transthoracic echocardiography 3 months after discharge. We have used several parameters to evaluate right ventricular function, including TAPSE, S'wave velocity, Strain RV (STR RV), shortening fraction (SF) and Tei index.

Results: The mean age of our patients was 62.28 ± 9.8 years, with extremes ranging from 34 to 89 years, and a clear male predominance (sex ratio 3.57). HFrEF was the most frequent (51.7%), followed by HFpEF (28.7%) and HFmrEF (19.5%).

A total of 72 (82.8%) patients had confirmed SAS. It was obstructive in 51 (58.6%) patients and central in 21 (24.1%). SAS was moderate to severe in 46% of cases. To study the impact of SAS according to its type, we divided the study population into 3 groups : "Non-SAS", "OSAS", and "CSAS".

TAPSE, SF and STR RD were more impaired in apneics patients (central and obstructive) than in non-apneics. ($18,20 \pm 3,48$ vs $20,60 \pm 3,74$ $p=0.003$; $39,20 \pm 11,19$, $44,91 \pm 8,29$ $p=0.010$; $-16,83 \pm 5,18$, $-19,26 \pm 3,57$ $p=0.015$ respectively).Tei index was more impaired in the OSAS group, while S'wave velocity was lower in the SACS. All parameters were significantly more impaired in moderate to severe SAS, highlighting the impact of sleep apnea syndrome, whatever its type, on right ventricular function. The most significantly reduced parameter was TAPSE, and was a predictor of OSAS (TAPSE $\leq 17,5$ mm (OR = 0,688; 95% CI : 0,512 – 0,926, $p=0,013$).

Conclusion: Right ventricular echographic parameters were more impaired in heart failure patients with OSAS or CSAS compared with the non-SAS group espacially in the moderate and severe forms.

Prognostic value of right ventricular echocardiographic parameters in acute heart failure

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Introduction: Acute heart failure poses significant burdens on patients and society in terms of quality of life, recurrent hospitalizations, morbidity, mortality, and healthcare costs.

Aim: to investigated right ventricular echocardiographic factors predictive of rehospitalization and mortality in patients hospitalized for acute heart failure.

Methods: This was a prospective, longitudinal, single-center study conducted from December 2020 to December 2022 at the cardiology department of the Internal Security Forces Hospital in La Marsa. It included 152 patients hospitalized for acute de novo or decompensated heart failure. Data were collected during index hospitalization, with follow-up at 3 and 6 months.

Results: Mean age was 65 ± 10 years, with a sex ratio of 2.3. Overall mortality rate was 19%, with 7 deaths during index hospitalization and a mean follow-up time of 3.7 months.

Multivariate analysis identified TAPSE and systolic pulmonary artery pressures as independent predictors of mortality in the right ventricle. ROC curve analysis revealed TAPSE < 16 mm predicted a threefold higher risk of mortality at 6 months (Se: 60%, Sp=55%, OR=3, 95% CI: 1.3-7.1, $p=0.008$). Pulmonary hypertension was a strong predictor of mortality, with a cutoff of 55 mmHg (Se: 70%, Sp: 70%, OR=4.9, 95% CI: 2-12, $p=0.001$).

However, no parameter of the right ventricle emerged as a predictor of rehospitalization or composite events.

Conclusion: This study focuses on TAPSE and PAPS as predictors of mortality